*Amer. Malac. Bull.* **29**: 135-137 (2011)

# RESEARCH NOTE

## Invasion of the Argentinean Paranense rainforest by the giant African snail *Achatina fulica*

**Diego E. Gutiérrez Gregoric, Verónica Núñez, Roberto Vogler, and Alejandra Rumi**

*CONICET*, Invertebrate Zoology Division, La Plata Museum (MLP), National University of La Plata, La Plata, Paseo del Bosque s/n (B1900FWA), Argentina

Correspondence, D. E. Gutiérrez Gregoric: dieguty@fcnym.unlp.edu.ar

**Abstract:** The tropical land snail *Achatina fulica* Bowdich, 1822, native to Africa, is reported for the first time in Argentina, in Puerto Iguazú City, Misiones Province. This city is surrounded by protected areas. Three randomly selected 1-$m^2$ plots were marked off in private gardens and in the area surrounding an urban stream for snail sampling. The high snail density detected could have ecological, sanitary, and economic consequences which have already been documented in other countries.

**Key words:** invasive land mollusc, Misiones, Argentina, impact

The giant African snail *Achatina fulica* Bowdich, 1822 is a tropical land snail native to East Africa that is considered as one of the world's most damaging pests (Lowe *et al.* 2000). In part, this is due to the introduction to several countries and traits that increase its invasion ability (polyphagous diet, adaptability, and dispersion). *Achatina fulica* was introduced into Brazil from Indonesia, in the 1980s for unsuccessful commercial purposes. Now, it is widespread in almost all of this country (Thiengo *et al.* 2007). In Argentina, at the present, 21 alien land gastropods have been recorded (Rumi *et al.* 2010), but the presence of *A. fulica* was unknown.

This note reports the introduction of *Achatina fulica* in Argentinean territory at Puerto Iguazú City (25°36′S, 54°35′W). This city is located in the extreme northwestern corner of Misiones Province, Argentina, at the border with Brazil and Paraguay. It is surrounded by protected areas such as the Iguazú National Park (676.2 $km^2$), Puerto Península Provincial Park (69 $km^2$), and Urugua-í Provincial Park (840 $km^2$) in Argentinean territory.

Individuals of *Achatina fulica* were collected in March 2010 (MLP N°13185). Sampling took place during day, with a temperature of 31 °C and humidity of 70%. Snails were collected from soil within three 1-$m^2$ plots randomly distributed in the study area. Two of them were located in private ornamental gardens, one with decomposing branches and creeping vegetation, and the other one below a banana tree. The third plot was located beside Mariposa stream (an urban stream). Specimens of *A. fulica* were classified in four size classes: recently hatched (up to 10 mm shell length), juvenile (10 to 40 mm), young adults (40 to 70 mm), and adults (>70 mm) (Simião and Fischer 2004). Densities of *A. fulica* and native gastropods per plot were calculated.

All size classes of *A. fulica* were found from eggs and newly-hatched juveniles to adult snails up to 110 mm in height.

Mean density was 107.6 snails/$m^2$ for *Achatina fulica* (range: 10 to 186) and 6 snails/$m^2$ for native gastropods (range: 1 to 10) (Table 1). Native gastropods belonged to Scolodontidae (*Happia* Bourguignat, 1889), Streptaxidae (*Rectartemon* Baker, 1925), and Orthalicidae (*Cyclodontina guarani* (d'Orbigny, 1835)) (Table 1). Other specimens of *A. fulica* were on trees, trunks, posts, walls, and roofs of houses. In spite of being nocturnal, individuals were found active during the day.

Reasons for the widespread introduction of *Achatina fulica* are numerous (Cowie and Robinson 2003). Although it is not possible to determine the vector, the introduction of this species in Argentina is probably linked to fishing. The use of snails as fish bait is a frequent practice and *A. fulica* from Brazil may have been accidentally released by fishermen into riversides of the Paraná and Iguazú Rivers (next to Puerto Iguazú City). Densities for *A. fulica* suggest a stable population. Residents reported that the species appeared approximately three years ago.

In the newly invaded area (Misiones Province), 25 native species of land gastropods occur: Charopidae (2 species), Euconulidae (1), Gastrodontidae (1), Helicinidae (3), Orthalicidae (5), Pupillidae (1), Scolodontidae (2), Solaropsidae (1), Streptaxidae (2), Strophocheilidae (3), Succineidae (1), and Veronicellidae (3) (Fernández 1973). The presence of *Achatina fulica* may pose a threat to native terrestrial molluscs through competition for food and refuge (Fischer and Colley

**Table 1.** Density (number/m$^2$) of *Achatina fulica* and native gastropods in Puerto Iguazú city, Argentina.

| | Habitat | | |
|---|---|---|---|
| Taxa | Garden | Garden banana tree | Stream |
| *Achatina fulica* | | | |
| Recently hatched | 171 | 33 | 0 |
| Juvenile | 10 | 93 | 0 |
| Young adults | 1 | 0 | 6 |
| Adults | 4 | 1 | 4 |
| **Total** | **186** | **127** | **10** |
| Native Gastropods | | | |
| *Rectartemon* sp. | 7 | 8 | 0 |
| *Happia* sp. | 0 | 2 | 0 |
| *Cyclodontina guarani* | 0 | 0 | 1 |
| **Total** | **7** | **10** | **1** |

2004). Furthermore, this species is known to be a snail predator (Meyer *et al.* 2008).

Creeping vegetation that constitutes refuge for micromolluscs (Scolodontidae and Charopidae) is consumed by the invasive species. The native snail *Megalobulimus sanctipaulis* (Ihering and Pilsbry, 1900) and *M. oblongus* (Müller, 1774), that superficially resemble *Achatina fulica*, may be vulnerable to competition with *A. fulica*, especially because they lay only a few eggs (Jurberg *et al.* 1988). The most effective control method for *A. fulica* is manual capture and destruction of specimens. This fact represents a risk for *Megalobulimus* species as uninformed people may confuse natives with invasive species (Cuezzo 2004).

*Achatina fulica* acts as an intermediate host of several parasites and may spread abdominal angiostrongyliasis (etiological agent: the nematode *Angiostrongylus costaricensis*) and the establishment of *A. cantonensis* and others diseases in Argentina (Caldeira *et al.* 2007).

Besides environmental and human health costs caused by this introduced species, economic losses may occur from the devastation of more than 100 crops and stored grains, and it is important to take immediate control measures. For example, in Misiones Province there are 263.8 km$^2$ of tobacco (*Nicotiana tabacum*), 348.99 km$^2$ of tea (*Camellia sinensis*) and 78.51 km$^2$ of cassava (*Manihot* spp.) plantations, which represent the 40%, 95%, and 97% of national production respectively (National Institute of Statistics and Censuses 2002). These plantations are susceptible to *Achatina fulica* (Raut and Barker 2002, Cuezzo 2004). Other plantations in the area, like the 1677.22 km$^2$ of mate (*Ilex paraguariensis*) that represent the 92% of national production, could be also affected. Control measures, preventive education, and surveillance are needed to prevent its further spread. However, it is important that control efforts, for instance using pesticides or physical/mechanical methods, do not affect the native species.

## ACKNOWLEDGMENTS

We thank Justo Herrera for local help and to the National Park Administration for communicate us the possible occurrence of this species in the affected area. This study was financially supported by *Conservation, Research and Education Opportunities* (CREO).

## LITERATURE CITED

Caldeira. R. L., C. L. G. F. Mendonça, C. G. Oliveira, C. Graeff-Teixeira, W. S. Lima, and O. S. Carvalho. 2007. First record of molluscs naturally infected with *Angiostrongylus cantonensis* (Chen, 1935) (Nematoda: Metastrongylidae) in Brazil. *Memorias do Instituto Oswaldo Cruz* **102**: 887-889.

Cowie, R. H. and D. G. Robinson. 2003. Pathways of introduction of nonindigenous land and freshwater snails and slugs. *In*: G. Ruiz and J. T. Carlton, eds., *Invasive Species: Vectors and Management Strategies*. Island Press, Washington, D.C. Pp. 93-122.

Cuezzo, M. G. 2004. Gigante africano: Una plaga potencial para nuestro país. *Vida Silvestre* **89**: 52-55 [In Spanish].

Fernández, D. 1973. *Catálago de la malacofauna terrestre Argentina*. Monografías, 4. Comisión de Investigaciones Científicas, La Plata, Argentina [In Spanish].

Fischer, M. L. and E. Colley. 2004. Diagnóstico da ocorrência do caramujo gigante africano *Achatina fulica* Bowdich, 1822 na APA de Guaraqueçaba, Paraná, Brasil. *Estudos de Biologia* **26**: 43-50 [In Portuguese].

Jurberg, P., H. M. Barros, L. A. L. Gomes, and A. C. S. Coelho. 1988. Superfamilia Bulimuloidea do Brasil. Bulimulidae *Thaumastus (Thaumastus) taunaisii* (Férussac, 1821), com dados biológicos e aspectos comportamentais (Mollusca, Gastropoda, Pulmonata). *Boletim do Museu Nacional* (Zoologia) **317**: 1-40 [In Portuguese].

Lowe, S., M. Browne, S. Boudjrlas, and M. De Poorter. 2000. 100 of the world's worst invasive alien species. A selection from the global invasive species database. *The Invasive Species Specialist Group (ISSG) a Specialist Group of the Species Survival Commission (SSC) of the World Conservation Union (IUCN)*. 12 pp. Published in *Aliens* 12, December 2000. Hollands Printing, Auckland.

Meyer, W. M., K. A. Hayes, and A. L. Meyer. 2008. Giant African snail, *Achatina fulica*, as a snail predator. *American Malacological Bulletin* **24**: 117-119.

National Institute of Statistics and Censuses. 2002. Censo Nacional Agropecuario. Available at: http://www.indec.gov.ar/nuevaweb/cuadros/11/c11_tot.xls; accessed 3 May 2010.

Raut, S. K. and G. M. Barker. 2002. *Achatina fulica* Bowdich and other Achatinidae as pests in tropical agriculture. *In:* G. M. Barker, ed., *Molluscs as Crop Pests*. CABI Publishing, Wallingford. Pp. 55-114.

Rumi, A., J. Sanchez, and N. Ferrando. 2010. *Theba pisana* (Müller, 1774) (Gastropoda, Helicidae) and other alien land molluscs species in Argentina. *Biological Invasions* **12**: 2985-2990.

Simião, M. S. and M. L. Fischer. 2004. Estimativa e inferências do método de controle do molusco exótico *Achatina fulica* Bowdich 1822 (Stylommatophora; Achatinidae) em Pontal do Paraná, Litoral do Estado do Paraná. *Cadernos da Biodiversidade* **4**: 74-83 [In Portuguese].

Thiengo, S. C., F. A. Faraco, N. C. Salgado, R. H. Cowie, and M. A. Fernandez. 2007. Rapid spread of an invasive snail in South America: The giant African snail, *Achatina fulica*, in Brasil. *Biological Invasions* **9**: 693-702.

**Submitted:** 19 May 2010; **accepted:** 13 July 2010;
**final revisions received:** 15 November 2010